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Range extension and distribution of the invasive Moreau's Tropical House Gecko, *Hemidactylus mabouia* (Moreau de Jonnès, 1818) (Squamata: Gekkonidae), in Suriname

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Abstract: We document a population of Moreau's Tropical House Gecko, *Hemidactylus mabouia* (Moreau de Jonnès, 1818), at a remote Amerindian village, Kwamalasamutu, Suriname, South America. This village is approximately 370 km southwest of the northern coastal region where the presence of *H. mabouia* was previously recorded. Numerous individuals and a gravid female provide evidence of a viable population. The morphological characters of the two female specimens examined fall within the range of characters recorded from African and Ascension Island specimens. Due to its overland inaccessibility, we believe that colonization occurred anthropogenically through air or boat transport from the coastal region.

Key words: invasive species; lizard; first report; anthropogenic colonization; South America

Moreau's Tropical House Gecko, *Hemidactlyus mabouia* (Moreau de Jonnès, 1818), is one of the most cosmopolitan introduced species of reptiles (Rödder et al. 2008; Fierro-Cabo and Rentfro 2014; Hughes et al. 2015), found in Africa, Madagascar, Ascension Island, the Antilles, Central and South America (Avila-Pires 1995; Baldo et al. 2008; Rödder et al. 2008 and Hughes et al. 2015), and North America in the states of Florida (Meshaka et al. 2004) and Texas (Fierro-Cabo and Rentfro 2014). *Hemidactylus mabouia* are thought to have reached South America from Africa by natural transmarine colonization or through anthropogenic means within the last 500 years (Kluge 1969; Carranza and Arnold 2006). Although *H. mabouia* was first reported for Suriname in the year 1770 by Hartsinck and subsequently by the Penard brothers in 1906, neither of these records were substantiated due to the possibility of misidentification (Hoogmoed 1980). The first documented specimen in Suriname was collected from the lower Marowijne river region in 1955 (Hoogmoed 1980). Currently, the distribution of this species is primarily restricted to multiple sites in the northern coastal area of Suriname (Hoogmoed 1973; Avila-Pires 1995; Powell et al. 1998). Although Hoogmoed (1980) mentioned the possibility of *H. mabouia* eventually reaching the far interior of Suriname, no specimens have been previously collected. Here, we document the first vouchered specimens of *H. mabouia* from the extreme southwestern interior of Suriname, in the Amerindian village of Kwamalasamutu.

The Amerindian village of Kwamalasamutu (02.3561° N, 056.7945° W) is situated on the north bank of the Sipaliwini River in southwest Suriname, approximately 10 km upriver from the confluence of the Sipaliwini and Coeroeni Rivers. The habitat in the village consists of exposed soil with intermittent patches of grass between buildings. Edges of the village are adjacent to primary rainforest, densely vegetated with high grasses, shrubs and trees. Two female *H. mabouia* specimens were captured on 23 June 2015 by hand from the wooden sided exterior walls of the Okopipi lodge. In addition to captured specimens, approximately ten individuals were observed on the same lodge and on adjacent buildings. Captured specimens were euthanized using lidocaine and subsequently placed in 4% formaldehyde. Lastly, specimens were transferred to 70% ethanol for long term preservation at the National Zoological Collection of Suriname (NZCS) under voucher number NZCS R677 and NZCS R678. The location of Kwamalasamutu where specimens were collected is indicated in relation to the previously documented northern populations of *H. mabouia* in Suriname, in addition to airplane landing strips throughout the country (Figure 1). The information used for plotting the recorded distribution

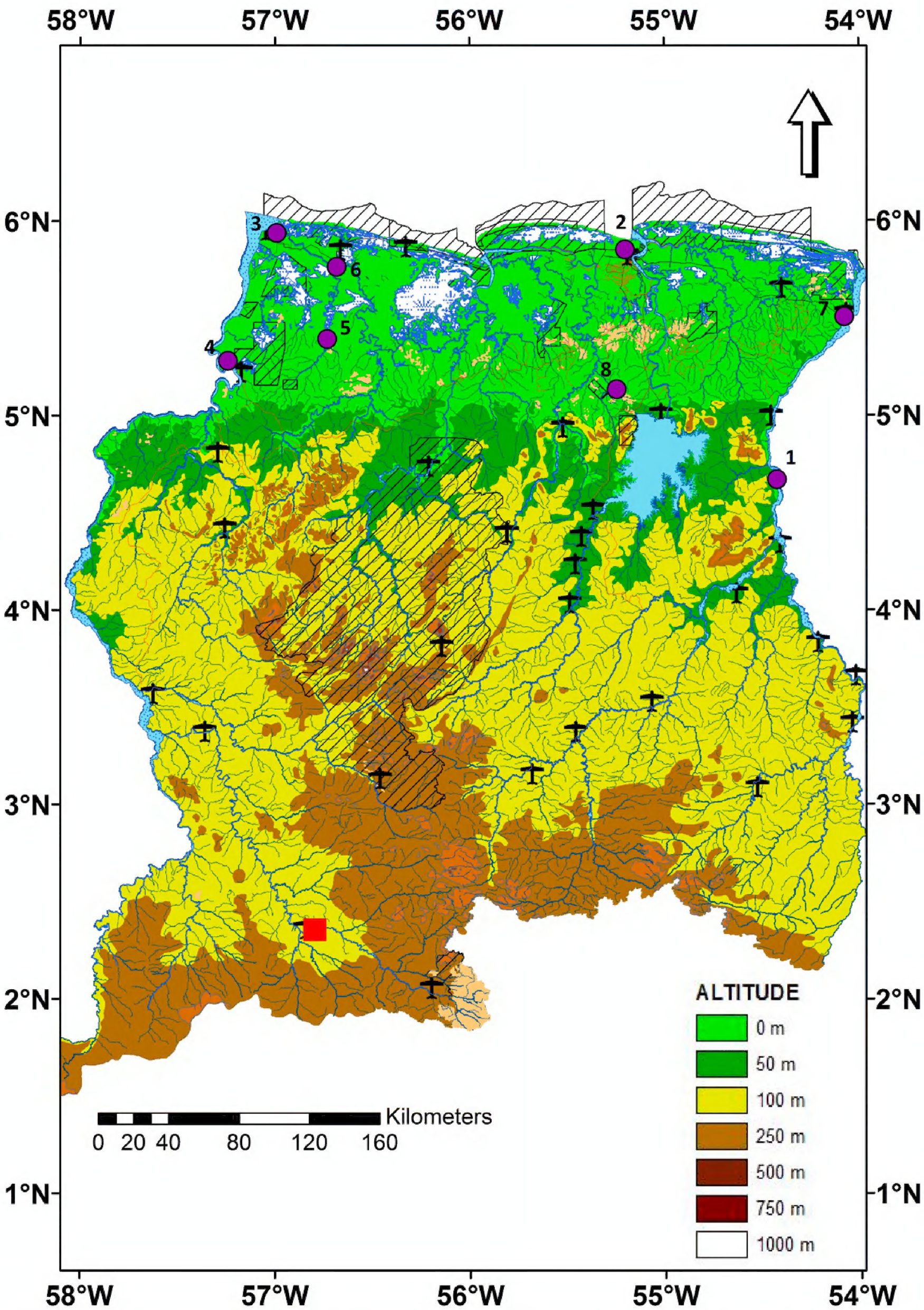

Figure 1. Overview of the known distribution and range extension of *Hemidactylus mabouia* in Suriname. Purple dots depict previous known locations, primarily from the northerly coastal region. The red square indicates the Amerindian village of Kwamalasamutu and range extension for the specimens reported in this paper. Symbols of airplanes depict airplane landing strips throughout Suriname. Locations on the map: (1) lower Marowijne, (2) Paramaribo, (3) Nieuw Nickerie, (4) Wakay, (5) Maratakka river, upstream from village Cupido, (6) Wageningen, (7) Albina, (8) railway 93 km S of Paramaribo. The map datum used is WGS84.

Figure 2. Non gravid, female specimen showing infestation of mites (Macronyssidae) visible as orangish spots on the ventral region.

of *H. mabouia* was taken from Hoogmoed (1973), Hoogmoed (1980), Avila-Pires (1995), and Powell et al. (1998). Both collected specimens were infested with ectoparasitic mites (family Macronyssidae) on their ventral regions (Figure 2). Permits for the fieldwork were kindly granted by the Nature Conservation Department of Suriname.

Snout vent length (SVL) was measured using the ImageJ software (http://rsb.info.nih.gov/ij/) whereas sex determination, number of loreal scales, supralabial scales, infralabial scales, and the number of lamellae under the fourth toe and fourth finger of the left foot and left hand were documented using a stereomicroscope. Individuals were identified to species using the following traits: shape of the pupil, number of supra labials, number of infra labials and the scalation under the fourth toe (Figures 3 and 4). All traits examined to allow reliable species identification were found in Kluge (1969), Hoogmoed (1973) and Avila-Pires (1995). One of the females was gravid and contained two eggs on either side of the ventral cavity (Figure 5). With the exception of SVL and loreal scales, the two females showed the same scale count number for each meristic character (Table I).

All morphometric counts were within the range recorded by Kluge (1969) for specimens from seven sub-Saharan African countries and Ascension Island. Virtually no genetic variation has been detected over this species range (Carranza and Arnold 2006). If this

Figure 3. Labial region and pupil shape of the non gravid female.

Figure 4. Image of the left foot of the gravid female showing the lamellae under the fourth toe. Arrow indicating the distance of the lamellae from the base of the foot.

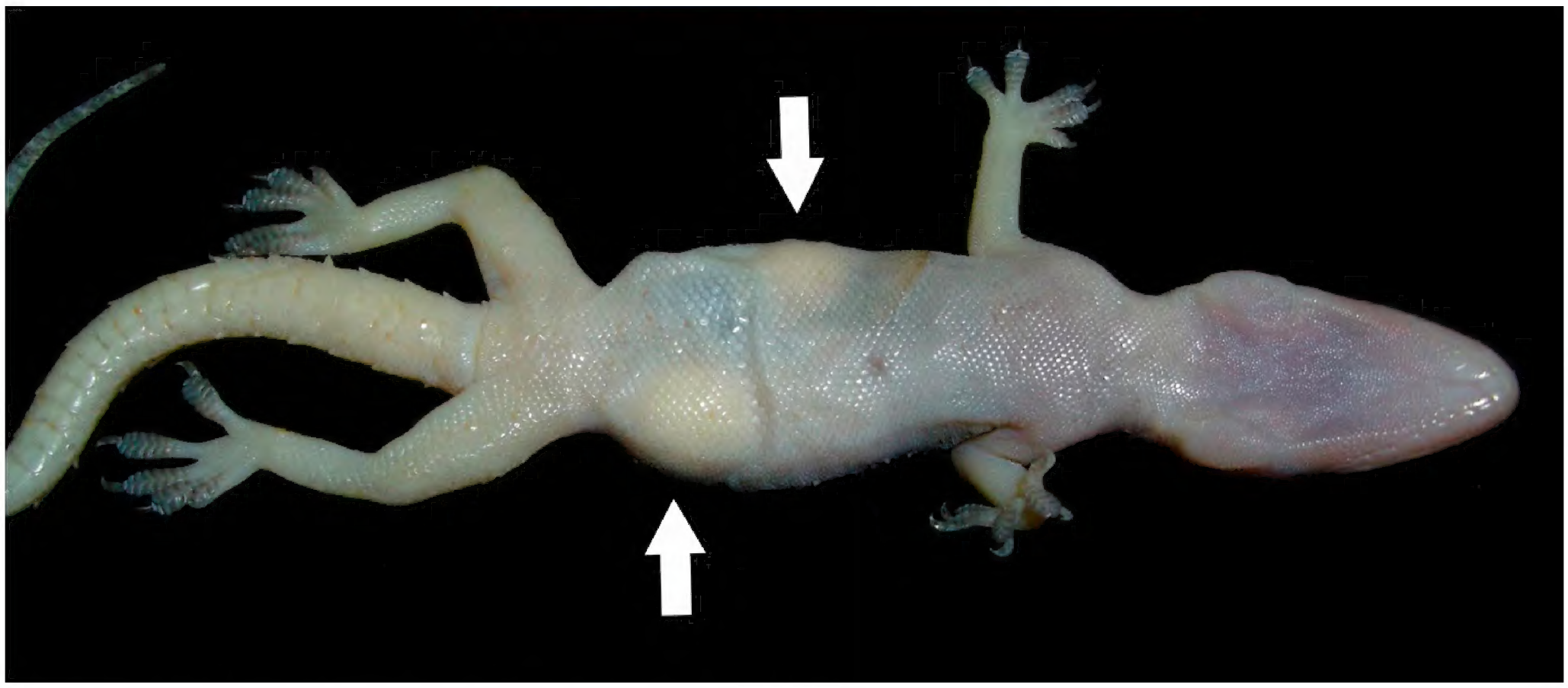

Figure 5. Ventral side of gravid female. Arrows indicate the position of the eggs.

Table 1. Comparison of morphometric measurements between two female *Hemidactylus mabouia* specimens captured in Kwamalasamutu, Suriname.

	Gravid Female	Non gravid Female
SVL (mm)	63.4	64.3
Supralabials	9	9
Infralabials	8	8
Loreal scales	16	14
Lamellae under 4th finger	8	8
Lamellae under 4th toe	10	10

species was initially introduced into the New World ~500 years ago (Kluge 1969, Carranza and Arnold 2006), our morphometric measurements suggests either that phenotypic plasticity is evolutionarily constrained or that they are anthropogenic habitat specialists with similar habitats in the Old and New Worlds. This potential stasis is interesting compared to the evolutionary rates of anole lizards, where measurable morphometric changes occurred in lizards intentionally introduced onto small Caribbean islands over a 10 to 14 year period (Losos et al. 1997). The documentation of *H. mabouia* in the isolated, interiorly located Amerindian village of Kwamalasamutu (Figure 1), approximately 370 km southwest of the nearest previously recorded sites for *H. mabouia* in Suriname and 500 km from a population in Para state, Brazil (Prudente et al. 2013) adds support to an anthropogenic dispersal hypothesis. In addition, previous studies of the natural history and dispersal patterns of *H. mabouia* in Brazil found the lizards exclusively associated with human dwellings or structures but not in the adjacent forests (Rocha and Bergallo 2011). Many fieldtrips undertaken to the interior of Suriname have never documented *H. mabouia* in pristine habitats. These factors argue against a natural dispersal hypothesis. Kwamalasamutu was established in 1975 with an airplane landing strip (O'Shea et al. 2011). The dispersal of *H. mabouia* to the interior may have been facilitated by the inadvertent transportation of lizards with supplies from the coastal region (Paramaribo) to the interior. We expect the actual distribution of this species in Suriname to be much more extensive then presently noted in this paper due to a dramatic increase in air transportation to previously inaccessible interior regions (Fig. 1). *H. mabouia* is expanding its range in South America (Fuenmayor et al. 2005, Rödder et al. 2008, Rocha and Bergallo 2011). The potential impact of *H. mabouia* on two native species of geckos, namely *Gonatodes humeralis* (Guichenot, 1855) and *Thecadactylus rapicauda* (Houttuyn, 1782) inhabiting the general area around Kwamalasamutu, is unknown. *H. mabouia* is generally associated with anthropogenic structures which may limit its impact on native species. However, *H. mabouia* has negatively impacted a number of native species irrespective of ecotype (Rödder et al. 2008, Hughes et al. 2015) warranting further investigation of this phenomenon. Additional surveys of other interior indigenous villages will help elucidate the current distribution of *H. mabouia* in Suriname. Genetic comparisons between Surinamese populations and those from other locations in the New World and Africa may reveal if these populations were the result of single or multiple founding events.

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